square, by the method previously explained. It will be unnecessary to prolong the present article by giving any examples of larger squares of this class, but the simple forms of magic rectangles for

23	2	21	4	19	6	17	8	9	10	13
1	22	3	20	5	18	7	16	15	14	11

Fig. 23.

29	2	27	4	25	6	23	8	9	20	11	18	13
1	28	3	26	5	24	7	22	21	10	19	12	17

Fig. 24.

18^2 and 22^2 and 26^2 magics, shown in Figs. 22, 23 and 24, may be of some assistance to those who desire to devote further study to these interesting squares.[3]

W. S. ANDREWS.
L. S. FRIERSON.

A NEW THEORY OF INVENTION.

A Russian engineer, P. K. von Engelmeyer of Moscow (Petersburger Chaussée 42), has published a little book on invention and its significance in our industrial life under the title *Der Dreiakt* (Berlin, Carl Heymann's Verlag) in which he claims that man is not only a political being (ζῷον πολιτικόν) as Aristotle claims, but also and mainly a technical being (ζῷον τεχνικόν), and he means it in the same sense in which Franklin called man a "tool-making animal."[1]

Mr. Engelmeyer defines technique as the art of reproducing artificially or intentionally certain desired phenomena (p. 17) and he calls attention to the fact that we are surrounded by the products of invention. Our clothes, the light and heat in our houses, our mode of traveling, in short, all that is called culture and civilization has

[3] More generally, if p, q are relative primes, the square of order pq will be magic on its pq rows, pq columns and $2pq$ diagonals, and at the same time p^2-ply and q-^{2}ply, if it be constructed with the paths $\begin{vmatrix} p, q \\ q, p \end{vmatrix}$, and the period be taken from the continuous diagonal of the magic rectangle $p \times q$. The limitations are dictated by the magic rectangle. Evidently p and q must both be > 1, and consecutive numbers must fail if the order is $\equiv 2 \pmod 4$; in all other cases consecutive numbers will suffice. C. P.

[1] See the author's *The Philosophy of the Tool*, p. 1.

been invented at various times. Some inventions have been made by conscious endeavor, others by accident.

Our author distinguishes four characteristics of invention: (1) its artificial nature—man interferes with natural conditions and introduces a human element into them: (2) teleology—inventions must be designed, they must serve a purpose; (3) surprise, by which word our author means that they must be something new or original; we do not call invention what is merely an application of former experience; (4) unity—every invention is a kind of a system, an organic whole, and the members must be integral parts of a new entirety. Discovery is somewhat different from invention, but there is a domain which belongs practically to both invention and discovery. Newton's law of gravitation is a discovery, but mathematical formulas are both.

Mr. Engelmeyer quotes Goethe approvingly when he says: "man does not experience or enjoy without at the same time being productive," thus implying that invention is an indispensable element in human existence. There are three fields of human activity. When man devotes his efforts to purposes of utility, the result is called invention; when his efforts are devoted to cognition, the result is called discovery; when this result serves esthetical pleasure it is called a work of art. Just as all three domains are ultimately one, so there must be but one theory of invention which our author calls by the Greek name "Heurology," and in so far as it expresses this union he calls it an act of three, or in German *Dreiakt*.

This theory of the *Dreiakt* is the subject of the main part of the book, and the author has consulted the patent laws of different nations for details and illustrations. From the standpoint of his conception he distinguishes between the product and the method of an invention; the former is the effect accomplished, the latter is the arrangement of parts, the combination of substances in definite proportions, the way in which substances are treated to change their nature. The patent lawyer must consider the principle which comprises the effect together with the way in which it is produced. Examples are furnished by the sewing machine, the bicycle, hydraulic systems, aeronautics, fire arms, chemical inventions, cement, explosives, photography, Bessemer steel, etc.

The concluding chapter of the book is devoted to the application of the *Dreiakt* to patent laws and technical instruction. The universality of the principle of the *Dreiakt* finds appreciation in the proposition that the human will itself is a *Dreiakt*. Our auther

gives credit to O. Schanze who has published his views on the same subject under the title *Beiträge zur Lehre von der Patentfähigkeit*, fascicle 2, pages 243-255 (Berlin, Siemens, 1904). He uses the term *Dreiakt* in a slightly different sense and speaks of three fundamental energies: (1) intention or will, (2) reflection or knowledge, (3) practical skill. These characterize every act of creation as a *Dreiakt*, (1) the aim which constitutes the teleology of the work, (2) the plan or design which logically determinates the work and (3) its execution. Schanze applies them to practical problems, especially to these three: *a*, Who among several collaborators is the author of the invention and who merely an assistant; *b*, how far in its application is an invention entitled to protection by patent; and *c*, at what state of completion does an invention acquire the right to be patented. P. C.